

Dynamically Adaptable Component-based Data Link Systems (DACDLS)

Dwight E. Cass
DASADA Kick-off
Meeting
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DACDLS Dynamically Adaptable Component-based Data Link Systems



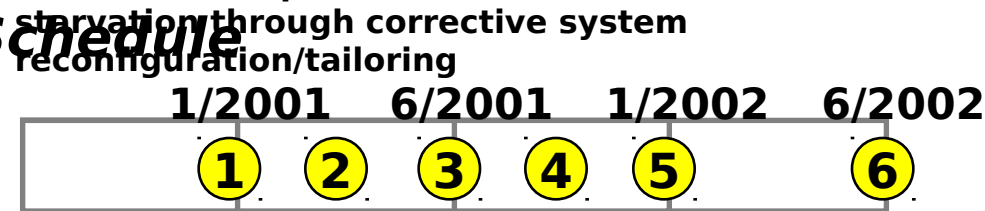
New Ideas

- Measure component's ability to function within a system through specification-based testing of its conformance to formal architectural model of system
- Combine this metric with measurement of component's resource consumption to select optimal candidate
- Automatically generate gauges to measure component's run-time compliance to architectural model
- Detect and respond to real-time resource

Impact

- New paradigm for the creation and operation of real-time mission critical avionics systems:
 - Black-box avionics replaced with tailorable component-based avionics that adapt to dynamic changes in mission requirements
 - Component libraries enable adaptations to be dynamically shared among mission assets
 - In-flight reconfiguration enables rapid response to highly dynamic theaters of operation

Schedule



1. Baseline Architectural and Target Execution Platform Models
2. Configuration Strategy Engine Infrastructure
3. Assembly Gauges
4. Consumption Gauges
5. Diagnostic Gauges and Reconfiguration Engine
6. Performance Gauges

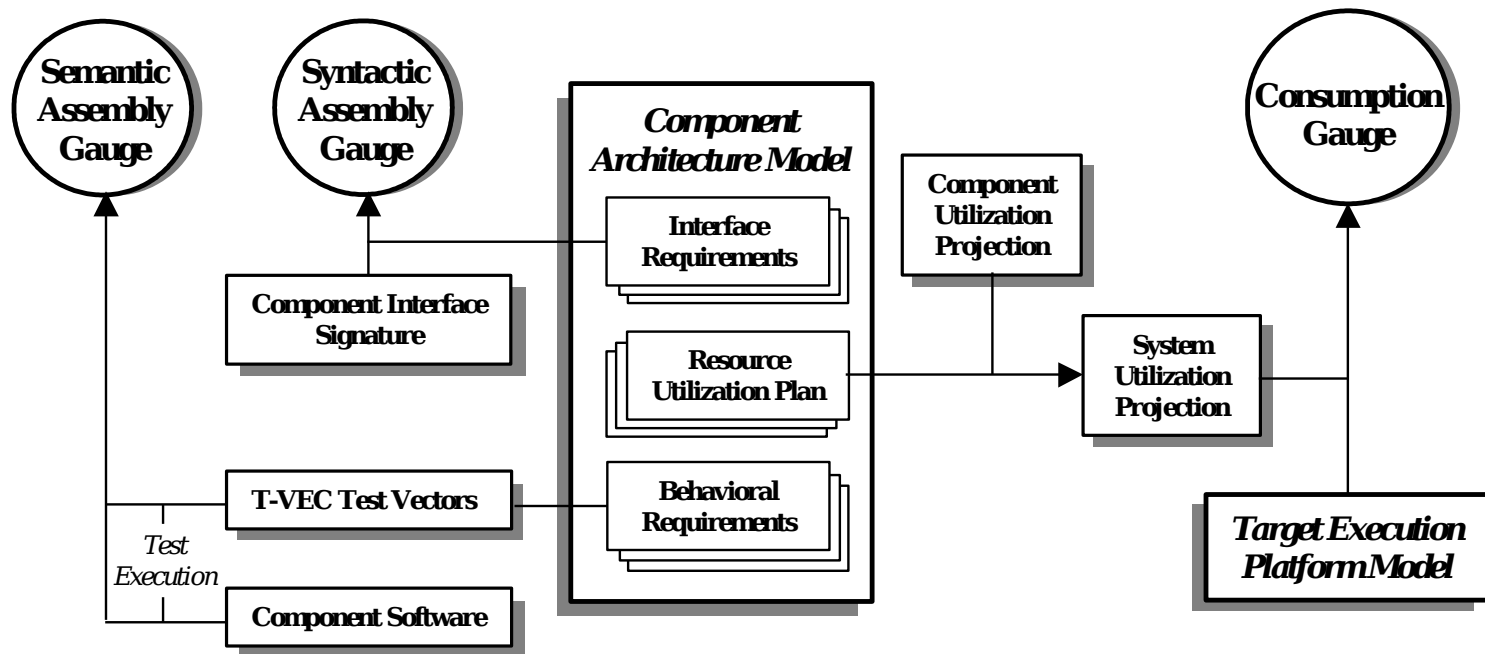
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DACDLS: Four Major Gauge Classes

	Functional Correctness	Resource Utilization
Composition on <i>T-VEC</i>	Component Architecture Model Assembly Gauges Measure syntactic and semantic distance from the functional requirements	Target Execution Platform Model Consumption Gauges Measure declared resource utilization and
Operation <i>CEP</i>	requirements Diagnostic Gauges Measure behavior in terms of semantic divergence from the functional requirements	schedulability against predicted availability Performance Gauges Measure deviation in actual resource consumption from original allocation

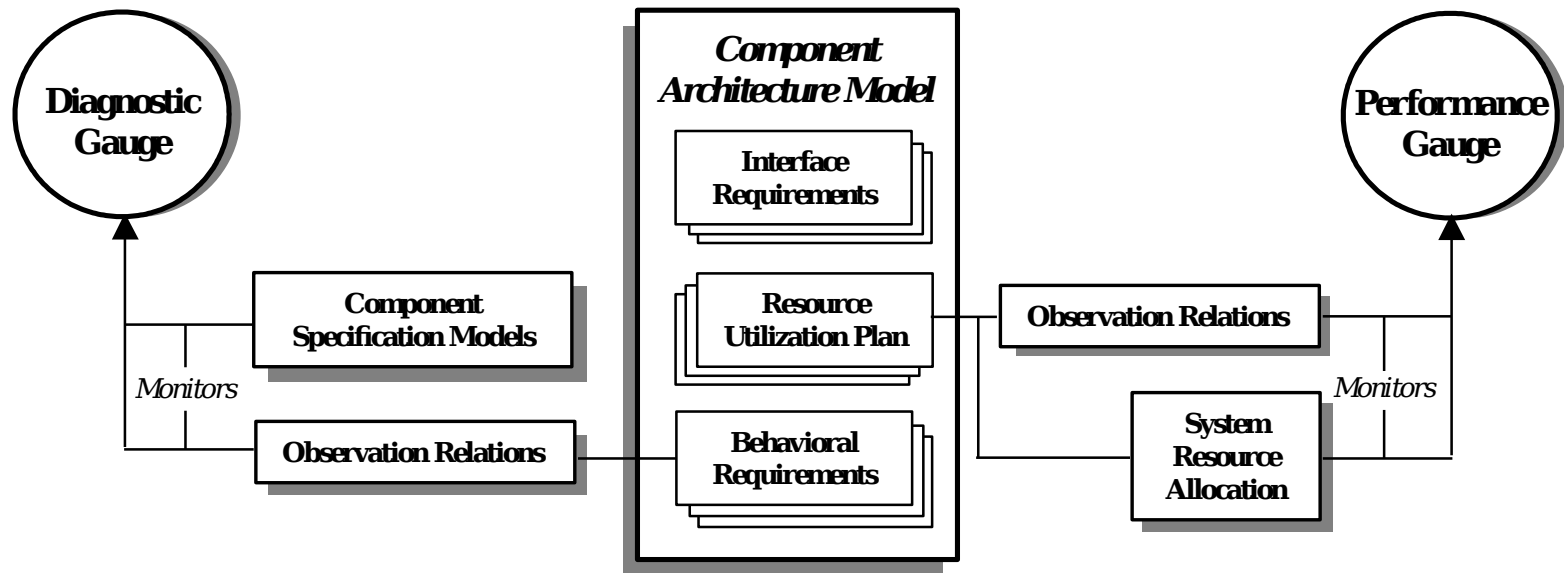
- Two Major Technology Components Form The Gauges
 - *T-VEC* Tests Components To Measure Compliance To Model
 - *CEP* Monitors Discrete Execution Events To Ensure Compliance To Model

DACDLS: Composition Gauges



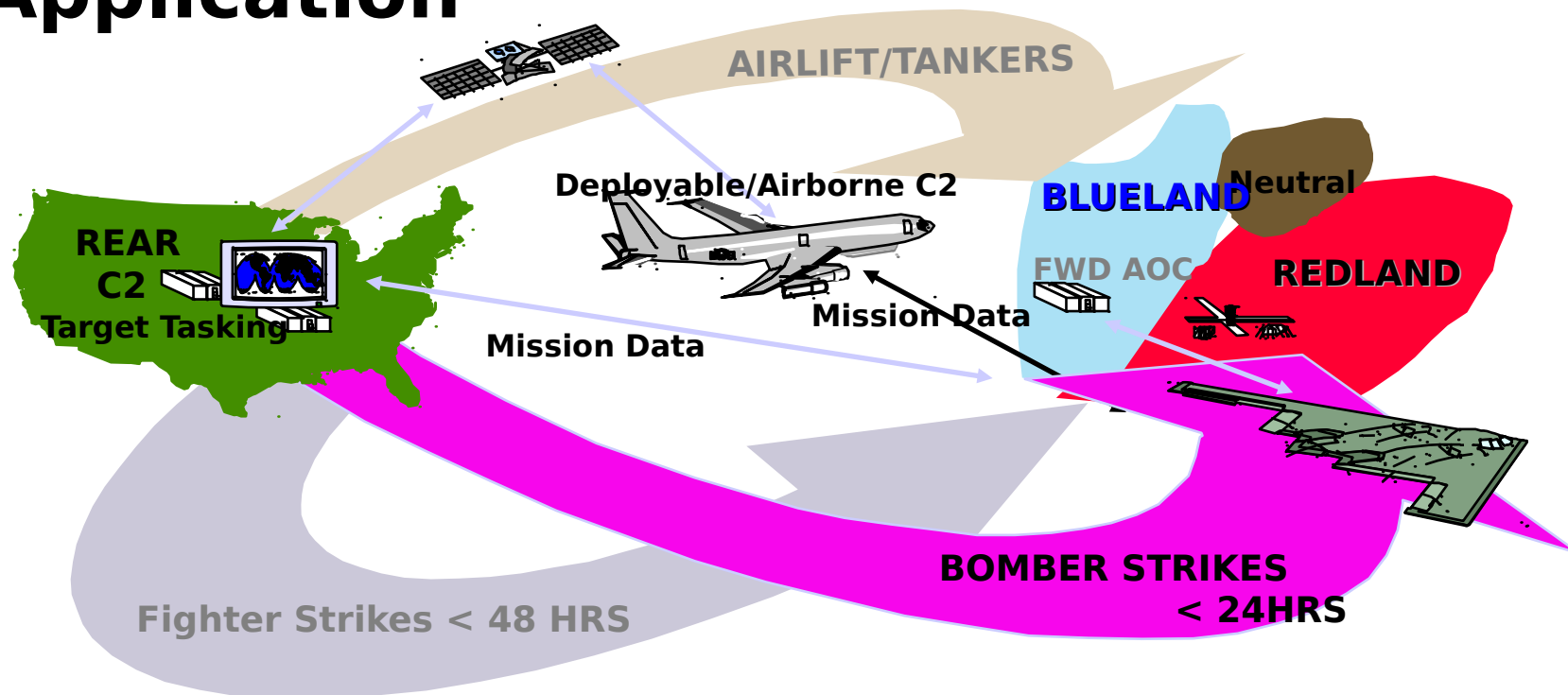
- *T-VEC* Tests Each Component Against Model
 - *T-VEC* Test Vectors Are Generated From The Architectural Model And Used To Drive The Functional Tests
 - Tested Resource Utilization Is Measured And Compared To Resource Utilization Plan (CPU, % of Minor Cycle, Memory, etc.)

DACDLS: Operation Gauges



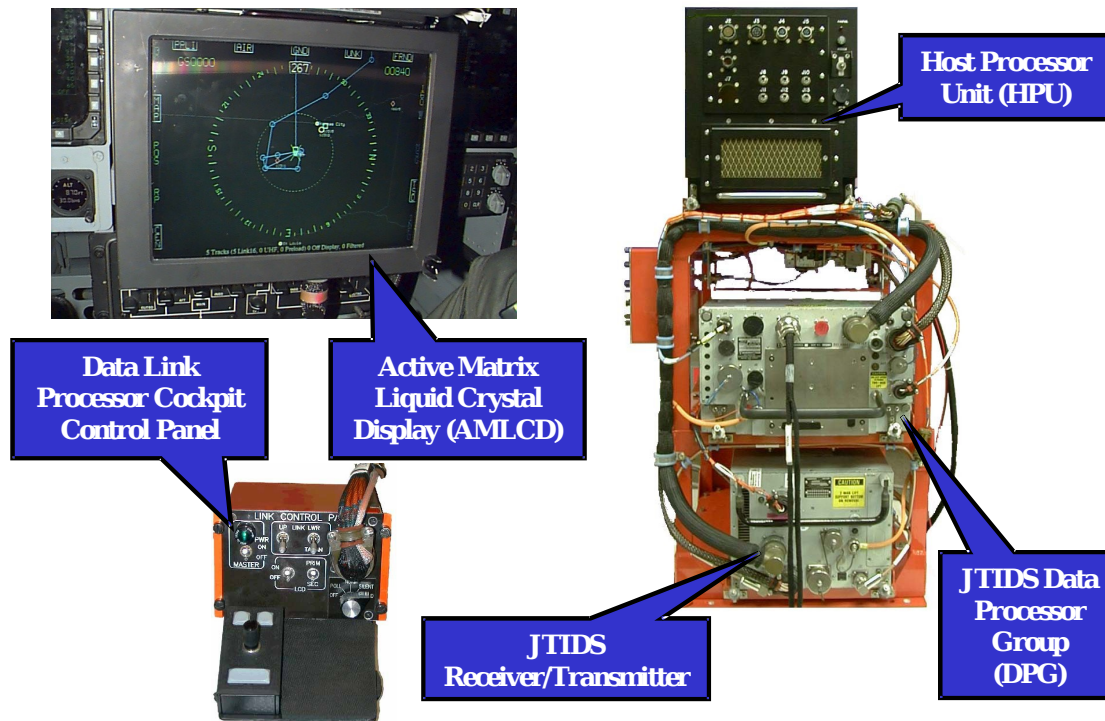
- Diagnostic and Performance Gauges Are Implemented As CEP Event Monitors
 - Event Monitors Are Automatically Generated During System Composition
 - *T-VEC* Test Vectors Identify Key Monitoring Events

DACDLS: JEFX99 Demonstration Application



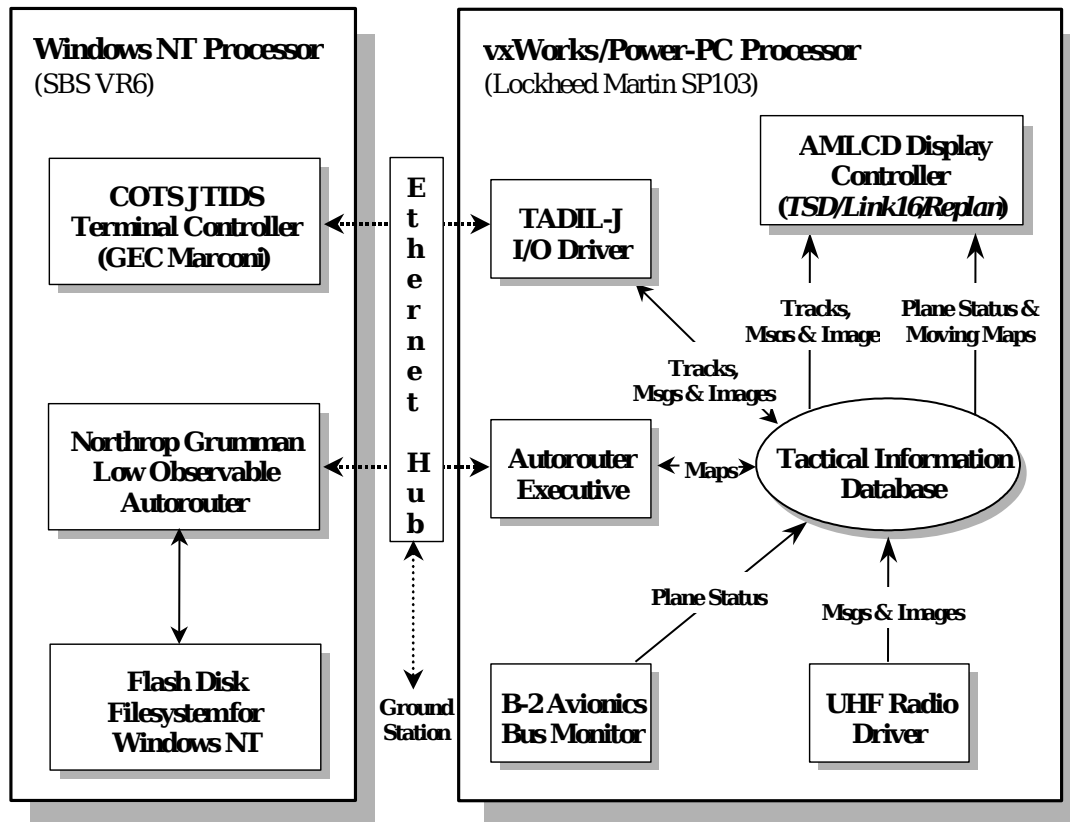
- Demonstrated B-2 Flexible Re-Targeting
 - Bombs On Target Within 24 Hours
 - Ability to Accurately Strike High Value, Time Critical Targets
- Demonstrated Operational Value of Receiving Digital Mission Data

DACDLS: JEFX99 Demonstration Hardware



- COTS Based “Flying Laboratory” Hardware Solution
 - Dual Processor System (PowerPC and Pentium)
 - Ethernet and MIL-STD-1553 Communications
- Government Owned Operational Hardware Currently Flying

DACDLS: JEFX99 Demonstration Software



- Collection Of Components Of Various Sizes And Complexity
 - GEC Marconi JTIDS Terminal Controller
 - Northrop Grumman LO Autorouter
 - UHF Radio Driver
 - 1553 Bus Monitors

- Demonstration Application Provides Rich Environment In Which To Evaluate DASADA Technologies

DACDLS: Conclusions

- Program Combines Highly Relevant Military Problem With Novel Approach To Avionics Software Development
 - Combines Formal Testing Approach With Resource Allocation Prediction and Measurement To Ensure Safe, Accurate, and Predictable System Operation
- First Phase Of Program Will Demonstrate Approach In Laboratory Setting
- Second Phase, With The Help Of The B-2 SPO, Can Provide A Flying Demonstration Of Technology
 - Work Should Be Combined With JEFX02 Demonstration